CLAIMS

We claim:

1. A liquid crystal device comprising:

a pair of opposed substrates having a gap therebetween;

a liquid crystal material disposed in said gap; and

polymer micro-structures formed between said substrates, wherein the micro-structures are formed by polymerizing a prepolymer, and wherein the micro-structures have a shape and spatial location determined by the director field of said liquid crystal material.

2. A liquid crystal device according to claim 1, wherein said microstructures are affixed to said at least one of the substrates.

3. A liquid crystal device according to claim 1, additionally comprising an alignment layer disposed on at least one of said substrates.

4. A liquid crystal device according to claim 3, wherein said alignment layer is selected from the group consisting of polymers, silicon oxide layers and surfactants.

5. A liquid crystal device according to claim 3, wherein said alignment layer produces a homogeneous planar geometry of the director field.

6. A liquid crystal device according to claim 3, wherein said alignment layer produces a homogeneous tilted geometry of the director field.

7. A liquid crystal device according to claim 3, wherein said alignment layer produces a homeotropic geometry of the director field.

8. A liquid crystal device according to claim 3, wherein said alignment layer produces a patterned geometry of the director field with different alignment properties at different regions of the cell

9. A liquid crystal device according to claim 1, wherein said liquid crystal material is selected from the group consisting of nematic liquid crystal material, cholesteric liquid crystal material, smectic liquid crystal material and columnar liquid crystal material.

10. A liquid crystal device according to claim 1, wherein said prepolymer is selected from the group consisting of UV-curable prepolymers and heat-curable prepolymers.

11. A method for fabricating a liquid crystal device having polymer micro-structures, the method comprising the steps of:

preparing a mixture comprising a liquid crystal material and a prepolymer;

providing a first and second cell wall structure, said first and second cell wall structures optionally having electrodes disposed on facing sides of said first and second cell wall structures, and, optionally having an alignment layer disposed on at least one of said electrodes;

disposing said mixture into a space between the first and second cell wall structures;

causing said liquid crystal material to assume a predetermined orientation with a non-uniform spatially distorted director field; and

exposing said mixture to conditions which cause polymerization of the prepolymer and formation of polymer microstructures between the cell walls.

12. A method for fabricating a liquid crystal device having polymer micro-structures according to claim 11, wherein said mixture comprising a liquid

crystal material and a prepolymer comprises between about 0.1 percent and about 50 percent prepolymer.

13. A method for fabricating a liquid crystal device having polymer micro-patterns according to claim 11, wherein said liquid crystal material is selected from the group consisting of cholesteric liquid crystal material, nematic liquid crystal material, columnar liquid crystal material and smectic liquid crystal material.

14. A method for fabricating a liquid crystal device having polymer micro-patterns according to claim 11, wherein said prepolymer is selected from the group consisting of UV-curable prepolymers and heat-curable prepolymers.

15. A method for fabricating a liquid crystal device having polymer micro-patterns according to claim 11, wherein said first and second cell wall structures have electrodes disposed thereon, and wherein said step of causing said liquid crystal material to assume a predetermined orientation with a non-uniform spatially distorted director field comprises applying a voltage across said electrodes.

16. A method for forming polymer micro-structures, the method comprising the steps of:

preparing a mixture comprising a liquid crystal material and a prepolymer;

providing a first and second cell wall structure;

disposing said mixture into a space between the first and second cell wall structures;

causing said liquid crystal material to assume a predetermined orientation with a non-uniform spatially distorted director field; and

exposing said mixture to conditions which cause polymerization of the prepolymer and formation of polymer micro-structures between the cell walls.

17. The method for forming polymer micro-patterns according to claim 16, wherein the curable prepolymer is a UV-curable prepolymer and wherein the step of exposing the mixture to conditions which cause polymerization of the prepolymer comprises exposing the prepolymer to UV radiation.

18. The method for forming polymer micro-patterns according to claim 16, wherein the first and second cell wall structures additionally comprise electrodes disposed on facing sides of said first and second cell wall structures.

19. The method for forming polymer micro-patterns according to claim 16, wherein at least one of said first and second cell wall structures additionally comprise an alignment layer disposed thereon.

20. The method for forming polymer micro-patterns according to claim 16, wherein said mixture comprising a liquid crystal material and a curable prepolymer comprises between about 0.1 percent and about 50 percent curable prepolymer.

22. The method for forming polymer micro-walls according to claim 16, wherein said liquid crystal material is selected from the group consisting of nematic liquid crystal material, cholesteric liquid crystal material, columnar liquid crystal material and smectic liquid crystal material.

23. A method for forming a liquid crystal cell comprising the method for forming polymer micro-patterns according to claim 16.

24. A liquid crystal cell formed by the method of claim 16.